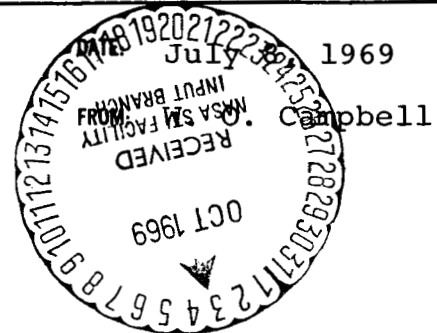


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SUBJECT: Apollo 11 Wind and Weather
Constraints - Case 320



MEMORANDUM FOR FILE

Apollo 11 wind and weather constraints take note of KSC thunderstorm probability. If one forms within five miles, Mission Rule 1-609 states that flight crew egress should be considered. Table I, based on 11 years of records, shows the May through September thunderstorm peak, with 0.418 the July daily probability. Activity this year has departed significantly from the statistical norm, with a peak in May and few in June.

Since they usually form in the afternoon, the a.m. portion of the launch window is less likely to be affected. Most form inland or over the west bank of Indian River and drift to the Cape. Few of those formed over the Gulf Stream are able to traverse the relatively cold water lying immediately offshore.

Table II countdown constraints are generally slightly less stringent because of further refinements in analysis methods.

Launch constraints in Figure 1 are much the same as those for Apollo 10 (A-10). Hold-down post clearance is assured up to a 50-knot wind coupled with pitch, yaw, and roll redlines of ± 0.29 , ± 0.29 , and ± 0.30 degrees, respectively. Tower clearance imposes additional constraints on +yaw, with Figure 2 showing the relation between it, wind magnitude and southerly direction.

The 162-foot wind and zonal profile to 500 feet determine CM land-landing probability in case of LES abort immediately prior to, and just after, launch. As indicated in Figure 3, intermediate values of wind require real-time analysis to determine land/water impact. The latter creates less personnel shock upon landing.

Constraints at 5...15 kilometers altitude in Figure 1 are somewhat more stringent than for A-10, chiefly because of recent structural data on the joint between S-II forward skirt

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and S-IVB aft interstage. However, expected 12-kilometer
July winds are still appreciably less than the constraints.

William O. Campbell

2032-WOC-drc

W. O. Campbell

Attachment

Tables I and II

Figures 1 thru 3

TABLE 1
DAYS AT KSC WITH X=0,1,---6 THUNDERSTORMS*

X= NUMBER OF THUNDERSTORMS PER DAY	MONTHS											
	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
0	335	295	308	299	266	187	177	185	228	311	321	334
1	4	9	20	18	43	77	80	89	54	17	6	3
2	2	4	9	10	25	40	47	30	33	9	3	2
3		2	3	3	3	17	26	24	12	4		2
4			1		3	6	9	10	3			
5					0	2	2	3				
6					1	1						
RELATIVE FREQUENCY OF AT LEAST 1 PER DAY	.018	.048	.097	.094	.220	.433	.481	.457	.309	.088	.027	.021

* OBSERVED OVER 11 YEAR PERIOD

TABLE 11
APOLLO 11 COUNTDOWN WIND CONSTRAINTS

COUNTDOWN CONFIGURATION										CONSTRAINTS		
S/F	LOX	LOX	LH ₂	LOX	LH ₂	LOX	LH ₂	DAMPER		KNOTS		10 ⁶ IN-LB
										AAA	S/V	AAA S/V
<u>MSS AT VEHICLE</u>	1.25	0	0	0	0	0	0	ON		64	64	177 204
<u>MSS AT VEHICLE</u>	1.25	0	0	0	0	0	0	<u>OFF</u>		28*	30*	128* 177
<u>MSS REMOVED</u>	1.25	0	0	0	0	0	0	<u>OFF</u>		28*	30*	128* 177
<u>MSS REMOVED</u>	1.25	0	0	0	0	0	0	<u>ON</u>		64	64	177 240
<u>S-IVB LOX LOADED</u>	1.25	0	0	0	0	100	0	<u>ON</u>		64	64	162 162
<u>S-11 LOX LOADED</u>	1.25	0	100	100	0	100	0	<u>ON</u>		64	64	183 183
<u>S-1C LOX LOADED</u>	1.25	100	100	100	0	100	0	<u>ON</u>		64	64	183 183
<u>S-11 LH₂ LOADED</u>	1.25	100	100	100	100	100	0	<u>ON</u>		64	64	183 183
<u>S-IVB LH₂ LOADED</u>	1.25	100	100	100	100	100	100	<u>ON</u>		60	60	172 172
<u>VEHICLE LOADED</u>	1.40	100	100	100	100	100	100	<u>OFF</u>		60	60	172 172
<u>LAUNCH RELEASE</u>									NA	≤30	NA	≤81.5

NOTES:

1. PRIOR LOADING OF S-1C RP-1, CSM CRYOGENICS, CSM/LM HYPERGOLICS, AND LM SHE.
2. SIGNIFICANT CHANGES IN CONFIGURATION UNDERScoreD.
3. AAA IS APOLLO ACCESS ARM. REMOVING AAA RAISES RESTRICTION TO S/V VALUE.
4. BENDING MOMENTS MEASURED AT VEHICLE STATION 790.
5. SIMULATION REQUIRED FOR LAUNCH RELEASE AT >30 KNOTS AND ABORT AT >25 KNOTS.

* AZIMUTH-DEPENDENT CONSTRAINT; LOWEST VALUE SHOWN.

①, ②, ③: PLOT MEASURED/CALCULATED VALUE OF ANY TWO
TO ESTABLISH TOWER CLEARANCE LIMIT ON THIRD PARAMETER.
WIND LIMIT IN SHADED AREA IS 50 KNOTS.

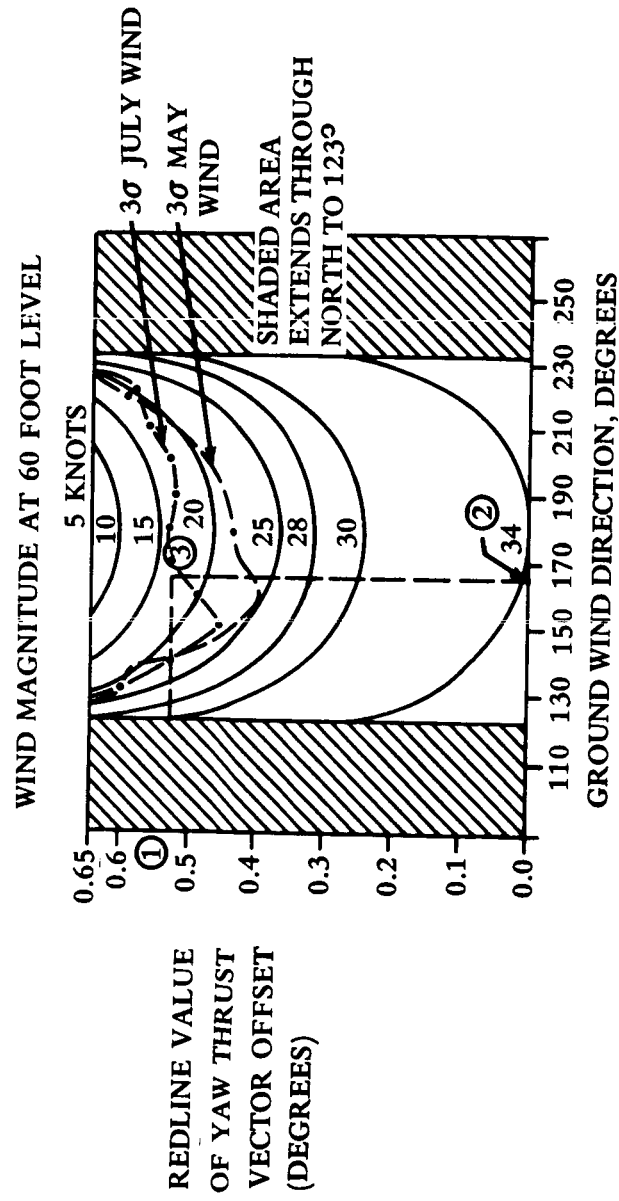


FIGURE 2 - TOWER CLEARANCE PARAMETERS

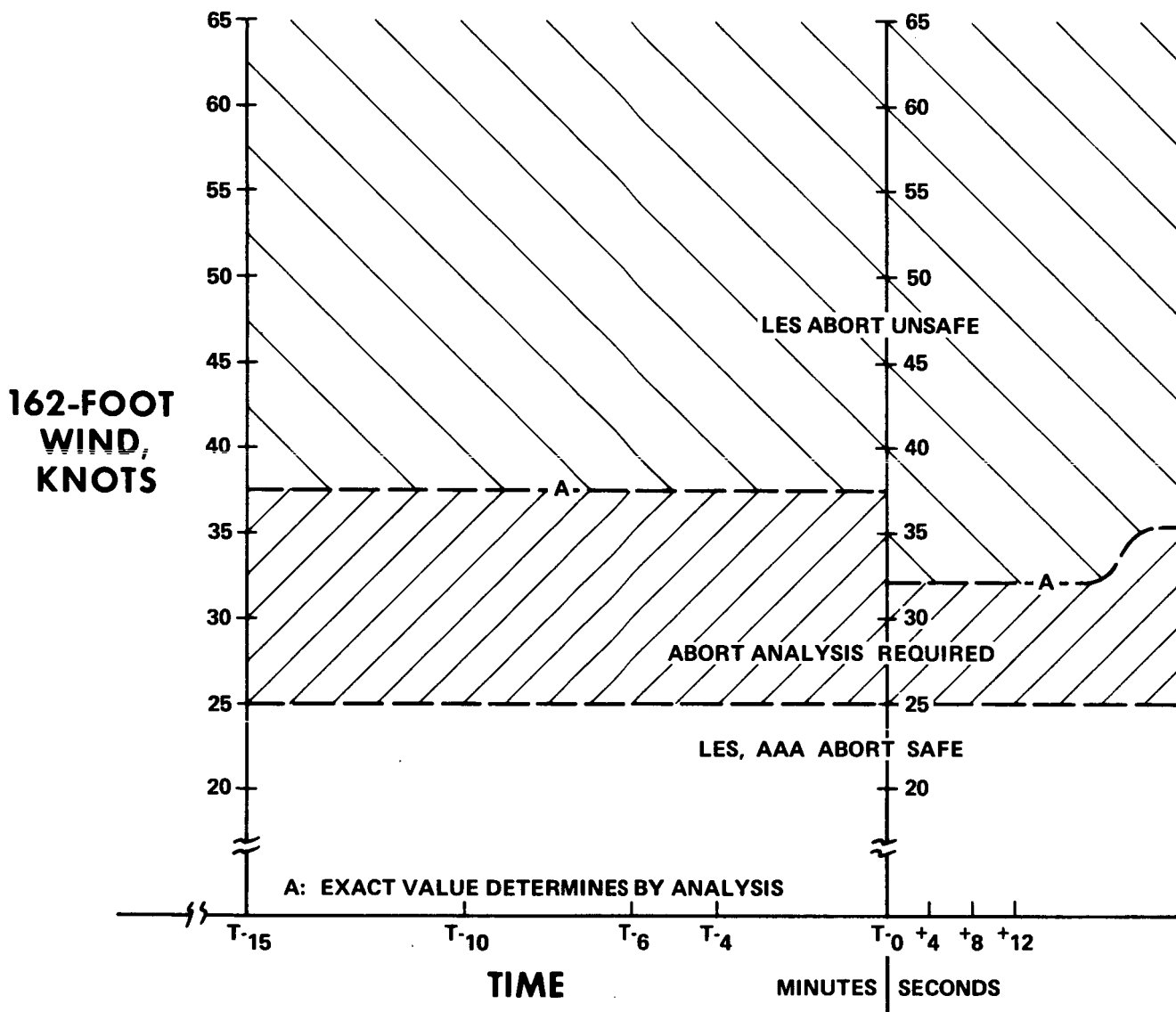


FIGURE 3 - PRE-AND POST-LAUNCH ABORT CONSTRAINTS VERSUS WIND

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Constraints - Case 320

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